

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET: 3851 (DSI-3851)

Surface Airways Observations (CDMP)

February 3, 2005

National Climatic Data Center

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1. Abstract: The dataset DSI-3851 consists of hourly U.S. surface airways observations (SAO). These observations extend as far back as 1928, from the time when commercial aviation began in the United States and meteorological observing stations were established at many airports (although occasionally, early-period SAO's were taken at U.S. Weather Bureau city offices). For most stations, this dataset extends through June of 1948.

Prior to this project, the pre-48 SAO's were only available in manuscript form. As part of the mission of the National Climatic Data Center's (NCDC) Climate Database Modernization Program (CDMP), NCDC embarked upon a massive project to preserve these paper records, and make their data more accessible. To that end, these records were keyed, leading to this dataset.

The major data variables are as follows: WBAN Station Identification Number, observational type, ceiling and cloud, visibility, present weather data, temperature, wind and pressure. The observations are generally recorded for the 24-hour period midnight to midnight, although many stations did not record 24-hour observations, especially early in the period when commercial aviation was just getting started.

Two output keying formats were created to adjust to an observational form change during the period. One format was generally used for years 1928-33, and the other for sets from around 1934 through June of 1948. Each keying format was designed to reflect the data as entered on the observational form for ease of keying by key entry personnel, who were not trained meteorological technicians. The "raw" observations which comprise the DSI-3851 dataset will be quality checked, to include data adjustments, and converted to NCDC's Integrated Surface Hourly (ISH) format.

Official surface weather observation standards can be found in the Circular N manuals. The images are available on a web based system, Web Search Store Retrieve Display (WSSRD), and will eventually be accessible through NCDC's On-Line store.

2. Keying Format Names and Definitions:

The following is the list of formats keyed from the Surface Airways Observations.

1928 - 1933 SAO OUTPUT KEYING FORMAT

(Revised September 22, 2003)

Data Records	Contents	Instructions
1-5	WBAN Number	Auto convert WBAN number
6	,	Comma delimited
7-10	Year	e.g. 1930

This keying format is established for the years 1928 - 1933. (See note #2)

11	,	Comma delimited
12-13	Month	e.g. 01 = January 02 = February . . 12 = December
14	,	Comma delimited
15-16	Day	right justify, zero fill e.g. 01 ... 31
17	,	Comma delimited
18-20	Time of Observation	Positions 18-19 are reserved for the hour. Position 20 is reserved for AM or PM. Code is as follows: A= A.M. P = P.M. e.g. if entry is 10 A.M. Position 18 = 1 Position 19 = 0 Position 20 = A Some observation forms may contain hours and minutes in the time field. When encountering this situation the time will be rounded to the nearest hour and the minutes shall be dropped. Additionally, some observation forms may include multiple observations within a given hour. When encountering this situation the observation prior to and closest to the hour shall be keyed. e.g. if entries are 12:15 p.m. and 12:45 p.m. key only the 12:45 p.m. observation as follows: Position 18 = 1 Position 19 = 3

Position 20 = P
 If times represent 24 hour clock key to the nearest hour:
 e.g. if entry is 1051
 Position 18 = 1
 Position 19 = 1
 Position 20 = blank

21	,	Comma delimited
22-23	Sky Conditions (Under General Condition Column)	See breakout below
22	Sign Layer (First Cloud Layer)	+ = High - = Low This field should never be blank unless clear (no clouds)
23	Amount First Cloud Layer	Sky condition symbol amounts are as follows: 0 = Clear 1 = Thin Scattered 2 = Scattered 3 = Thin Broken 4 = Broken 5 = Thin Overcast 6 = Overcast e.g. if actual entry is Hi Thin Ovc Position 22 = + Position 23 = 5
24	,	Comma delimited
25-26	Sky Condition (Second Cloud Layer when reported)	See breakout below
25	Sign Field (Second Cloud Layer)	Same as rules for Position 22 above
26	Amount Second	e.g. if actual entry is Lwr

	Cloud Layer	Sctd Clds Position 25 = - Position 26 = 2
27	,	Comma delimited
28-30	Weather Condition (Under General Condition Column)	See breakout below
28	Sign Field	- = Light No symbol = Moderate (blank fill) + = Heavy or Severe
29-30	Weather Condition (First Entry)	left justify, blank fill Weather Conditions are as follows: R = Rain S = Snow E = Sleet ZR = Freezing Rain SP = Sprinkling M = Mist SQ = Snow Squall RQ = Rain Squall SF = Snow Flurries A = Hail T = Thunderstorm TN = Tornado HC = Hurricane SS = Sandstorm WC = Weather Changeable e.g. if entry is MDT Thunderstorm Position 28 = blank Position 29 = T Position 30 = blank
31	,	Comma delimited
32-34	Weather Conditions (Second Entry)	Same as rules above for Weather Conditions (First Entry). e.g. if entry is Light Hail Position 32 = - Position 33 = A

		Position 34 = blank
35	,	Comma delimited
36-38	Weather Conditions (Third Entry)	Same as rules above for Weather Conditions (First Entry). e.g. if entry is HVY Freezing Rain Position 36 = + Position 37 = Z Position 38 = R
39	,	Comma delimited
40-42	Obstructions to Vision (Under General Condition Column)	See breakout below
40	Sign Field	+ = Heavy, Dense or Thick No symbol = Moderate (blank fill) - = Light
41-42	Obstructions to Vision (First Entry)	left justify, blank fill Symbols for Obstruction to Vision: F = Fog GF = Ground Fog H = Haze K = Smoke D = Dust e.g. if entry is Dense Ground Fog Position 40 = + Position 41 = G Position 42 = F
43	,	Comma delimited
44-46	Obstructions to Vision (Second Entry)	Same as rules above for obstructions to vision (First Entry) e.g. if entry is Light Dust Position 44 = - Position 45 = D

		Position 46 = blank
47	,	Comma delimited
48-53	Ceiling	See breakout below
48	Ceiling Classification	U = UNL/Unlimited E = ETD/Estimated e.g. if ceiling classification entry is UNL Position 48 = U Positions 49-53 = blank
49-53	Ceiling (Feet)	right justify, blank fill THSD/Thousand HND/Hundred e.g if entry is ETD6THSD Position 48 = E Position 49 = blank Position 50 = 6 Position 51 = 0 Position 52 = 0 Position 53 = 0 e.g. if ceiling entry is zero Position 48-52 = blank Position 53 = 0
54	,	Comma delimited
55-59	Visibility (Miles or Feet)	Visibility will normally be keyed to whole miles or miles and fractions of a mile. However there may be a few occasions in which the visibility shall be keyed to feet. Whenever visibility is observed in miles and fractions of a mile the first three data record positions represent whole miles. The last two positions represent fractions. Fractions only reported when visibility is less than 4 miles. e.g. if actual entry is 1 1/4 miles Positions 55-56 = blank Position 57 = 1 Position 58 = 1 Position 59 = 4

e.g. if actual entry is zero
 Positions 55-56 = blank
 Position 57 = 0
 Positions 58-59 = blank
 If visibility classification is UNL then
 visibility shall be keyed as:
 Positions 55-57 = 999
 Positions 58-59 = blank

Coding instructions for fractions of a mile:

Entry	Key
1/10	10
1/16	16
1/8	18
1/4	14
5/16	56
3/8	38
1/2	12
5/8	58
3/4	34
7/8	78

When the visibility is reported in feet right
 justify, blank fill and key the letter F in
 position 55.

e.g. if entry is 500 feet
 Position 55 = F
 Position 56 = blank
 Position 57 = 5
 Position 58 = 0
 Position 59 = 0

60

,

Comma delimited

61-63

Wind Direction

left justify, blank fill
 If blank check the speed column for a C or
 calm. Then key direction as C. If wind
 direction and speed columns
 are both blank leave blank.
 e.g. if entry is Calm
 Position 61 = C
 Position 62-63 = blank

e.g. if entry is SE
 Position 61 = S
 Position 62 = E
 Position 63 = blank

64 , Comma delimited

65 Wind Velocity Indicator 1 = Speed is measured in miles per hour.
 2 = Speed is measured in knots.
 3 = Speed is measured in meters per second.
 4 = Speed is estimated in miles per hour.

66-68 Wind Velocity right justify, blank fill
 If direction or speed is C then speed shall be keyed as follows:
 Positions 66-67 = blank
 Position 68 = 0
 e.g. if entry is 32
 Position 66 = blank
 Positions 67-68 = 32
 If wind velocity indicator = 4, then wind speed was reported using the following U.S. Weather Bureau descriptive terms. The mid-point value of each range is keyed into the velocity field (Positions 66-68) as indicated in the following table:

<u>Descriptive Term</u>	<u>Mid-Point Wind Speed (M.P.H.)</u>
Light (Lt)	4
Gentle (Gtl)	10
Moderate (Mdt)	15
Fresh	21
Strong	31
Gale	46
Whole Gale	63
Hurricane	78

69 , Comma delimited

70-74 Temperature Air temperature in Fahrenheit

will normally be keyed to whole degrees. However there may be a few occasions in which the air temperature shall be keyed to tenths of a degree, decimal implied. Position 70 is reserved for the sign field. If (+) leave blank. Position 74 is reserved for the tenths field. If no tenths field leave Position 74 blank.

e.g. if entry is zero

Position 70-72 = blank

Position 73 = 0

Position 74 = blank

e.g. if entry is -30.2

Position 70 = -

Position 71 = blank

Position 72 = 3

Position 73 = 0

Position 74 = 2

75

,

Comma delimited

76-79

Dew Point

Dew point temperature in Fahrenheit will normally be reported to whole degrees. However, there may be occasions in which the dew point shall be reported to tenths of a degree, decimal implied. Position 76 is reserved for the sign field. If (+) leave blank. Position 79 is reserved for the tenths field. If no tenths value leave Position 79 blank.

e.g. if entry is -3

Position 76 = -

Position 77 = blank

Position 78 = 3

Position 79 = blank

e.g. if entry is 79.9

Position 76 = blank

Position 77 = 7

Position 78 = 9

Position 79 = 9

80

,

Comma delimited

81-84	Barometer (Inches)	left justify, blank fill if entry is 29.88, decimal implied. Positions 81-84 = 2988
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Notes:

1. The General Condition field will be broken down into three separate fields: Sky Conditions, Weather Conditions and Obstructions to Vision.
2. 1933 was a transition year for the surface weather observation format. Some stations may be best keyed using the 1934 - 1948 keying format for portions of the 1933 period.
3. Whenever an element field has a value to be keyed, but the value cannot be determined because of illegibility or non-recognizable characters by the keyer then place a tilde (~) in the last position of that element field. This will provide the data user with information that an entry was made by the observer but could not be keyed. If sufficiently interested the user can view the image.

SAO 1934-1948 Output Keying Format
(Revised Dec 8, 2003)

Data Records	Contents	Instructions
1-5	WBAN Number	Auto filled from NCDC WBAN list
6	,	Comma delimited
7-10	Year	e.g. 1934 This keying format is established for the years 1934-1948, however because of the transition there may be portions of 1933 station forms that would be best keyed under this format
11	,	Comma delimited
12-13	Month	e.g. 01 = January 02 = February . .

12 = December

14	,	Comma delimited
15-16	Day	Right justify, zero fill e.g. 01, 02, ...31
17	,	Comma delimited
18-19	Observational type	<p>Key only the hourly observations, these may end near the hour, near the half hour or near the quarter hour depending on the time period. Once the record type was introduced circa 1934 , key only those records that contain a “R” as part of the designator, which generally appears in the date column. Right justify, blank fill, e.g. if = R, then Position 18 = blank 19 = R If = SR or RS, then Position 18 = R 19 = S</p> <p>If C or L only, do not key the record If no indication leave blank (these should be hourly records only and generally appear prior to the introduction of the indicator type) However, occasionally the observation type was not entered as required and in some cases the hourly (Record Observation) was indicated by underlining. If any doubt as to which ones are the hourly observations contact NCDC for clarification.</p>
20	,	Comma delimited
21-25	Time	local standard time (LST)
21-24		In general the times represent a 24 hour clock but occasionally they are entered as a.m. or p.m. times.

		If 24 hour clock, key time in positions 21-24 and leave position 25 blank, e.g. CS = Central Standard Time, ES = Eastern Standard Time, etc. Entries may range from 0000-2400. e.g. if entry = 0542, then positions 21-24 = 0542, position 25 = blank.
25	Time Indicator	Key A for AM. Key P for PM Key L for Local Time. Key W for War Time. If entry is 0120 CWT; then positions 21-24 = 0120, position 25 = W
26	,	Comma delimited
27-31	Ceiling	See breakout below
27	Ceiling Classification	U= UNL= Unlimited (>9750 ft) A =Aircraft report B = Balloon E = Estimated M = Measured P = Precipitation ceiling V = Variable ceiling W = Indefinite ceiling + = Last observed height of ceiling balloon before it disappeared without reaching the clouds. may also be blank
28-31	Ceiling height in feet	right justify, blank fill e.g. 2000 = 2000 if 800 Pos 28 = blank Pos 29 = 8 Pos 30 = 0 Pos 31 = 0 if entered as 3 THSD then, Pos 28 = 3 Pos 29 = 0 Pos 30 = 0 Pos 31 = 0

If entries are to nearest hundred feet
 continue to right justify blank fill (these will
 be adjusted by the conversion program)
 e.g. if entry = 20, then
 pos 28 = blank
 pos 29 = blank
 pos 30 = 2
 pos 31 = 0
 If entry = 200 then
 pos 28 = blank
 pos 29 = 2
 pos 30 = 0
 pos 31 = 0
 Note: If 10,000 (Circular N instructions sets
 the threshold at 9751 feet) or higher place a
 “U” in position 31 and blank fill positions
 28-30

32	,	Comma delimited
33-36	Height of First Cloud Layer	<p>Same rules as for ceiling height positions 28-31. e.g. if 2000 is reported, then, position 33 = 2 34 = 0 35 = 0 36 = 0</p> <p>Occasionally the height for a cloud layer as above will appear in the “Remarks” section. It will have to be located and entered into the correct position.</p>
37	,	Comma delimited
38	Sky Conditions possible sky conditions:	<p>numerical codes representing the</p> <p>0 = clear or less than .1 coverage 1 = thin scattered 2 = scattered 3 = dark scattered 4 = thin broken 5 = broken 6 = dark broken</p>

38

First Cloud Layer
Amount
(Sky Conditions)

7 = thin overcast
8 = overcast
9 = dark overcast
x = obscuration 10/10ths obscuration
* = partial obscuration (-X)

e.g. HI SCT CLDS = 2
BRKN CLDS = 5
HI THIN OVC = 7

If skies are clear (no clouds) the entry should be clear (clr); then position 38 = 0 ; occasionally the observer entry may be “no clouds”. Again position 38 = 0.
If field blank then leave blank.

Sky condition may also be represented by symbols as below:

Open Circle = Clear
Circle surrounding a single vertical mark = Scattered
Circle surrounding two vertical marks = Broken
Circle surrounding a plus sign = Overcast

The aforementioned symbols may have a + or - sign preceding which indicate the following:

+ = dark

- = thin


the symbols above followed by a black slant (/) indicates high cloud

e.g.

 = Clear; no clouds

 = Scattered Clouds

 = Broken Clouds

 = Overcast

X = total obscuration

- X = partial obscuration

e.g. - \oplus / 45 \ominus reported, then

Position 38 = 7

39 High cloud indicator

Back slash (/) following the first cloud entry symbol indicates high cloud. e.g. if entry is one of the following:

\ominus / = Hi Scattered Clouds

\ominus / = Hi Broken Clouds

\oplus / = Hi Overcast

Then position 39 = /

If the entry is before the use of symbols when it was written in abbreviations, e.g. “Hi BRKN CLDS” or “Hi OVC,” or “Hi SCTD CLDS”, etc. then also key a / in position 39.

Note: if SCTD CLDS/2000 is reported the / above does not mean high cloud as it does not follow a symbol.

40 ,

Comma delimited

41-46 Second cloud layer
(Where Reported)

Same rules as for first cloud group above (Positions 33-39) except there is no high cloud indicator in Position 39.

41-44 Height of Second
Cloud Layer

e.g. \oplus / 45 \ominus
Position 41 = blank
42 = blank
43 = 4
44 = 5

45 ,

Comma delimited

46	Second Cloud Layer Amount	Position 46 = 2 (Scattered clouds in example above)
47	,	Comma delimited
48-53	Third Cloud Layer (Where Reported)	Same rules as for second cloud layer (Positions 41-46). A third layer is generally not reported but when it is it is located in the “Remarks” section.
48-51	Height of Third Cloud layer	<p>e.g. Sky conditions ⊕ ⊕</p> <p>Remarks E16 ⊕ 8 ⊕</p> <p>Position 48 = blank Position 49 = blank Position 50 = 0 Position 51 = 8 The following positions would have been keyed for the first cloud layer based on information in the remarks column. Position 33 = blank Position 34 = blank Position 35 = 1 Position 36 = 6</p> <p>The E is not to be keyed.</p>
52	,	Comma delimited
53	Third Cloud Layer Amount	See example above for the amount of the third cloud layer Position 53 = 2 (Scattered)
54	,	Comma delimited
55-59	Visibility (miles and fractions)	Positions 55-57 restricted to whole Miles (rarely reaching 100 miles) and positions 58-59 for fractions of a mile. Fractions are only reported when visibility is less than 4 miles

drizzle/freezing
drizzle
Position 66 = fog/ground fog/haze/
tornado
Position 67 = rain squall/snow
squall
Position 68 = haze/sand/smoke
Position 69 = sleet/ice fog
Position 70 = drifting snow/
snow pellets/
snow grains

Note: The weather conditions may be entered under the General Conditions (earlier forms) or Weather Conditions (later forms). They may use the weather codes/symbols (e.g. ZR) or they may abbreviate the weather conditions i.e. MDT FRZG RAIN.

See Codes below

61	Rain/Freezing Rain/ Rain Showers	0 = Heavy Rain (R+) 1 = Moderate Rain (R) 2 = Light Rain (R-) 3 = Heavy Freezing Rain (ZR+) 4 = Moderate Freezing Rain (ZR) 5 = Light Freezing Rain (ZR-) 6 = Sprinkling (SP) 7 = Heavy Rain Showers (RW+) 8 = Moderate Rain Showers (RW) 9 = Light Rain Showers (RW-)
62	Thunderstorm/Dust	0 = Heavy (Severe) Thunderstorm (T+) 1 = Moderate Thunderstorm (T) 2 = Mild Thunderstorm (T-) 3 = Thick Dust (D+) 4 = Moderate Dust (Dusty) (D) 5 = Light Dust (D-) 6 = Thick Blowing Dust (BD+) 7 = (Moderate) Blowing Dust (BD) 8 = Light Blowing Dust (BD-) 9 = Mild Thunderstorm & Light Blowing Dust (T- BD-) A = Mild Thunderstorm & Moderate Blowing Dust (T- BD) B = Mild Thunderstorm & Thick

Blowing Dust (T- BD+)
 C = Moderate Thunderstorm &
 Light Blowing Dust (T BD-)
 D = Moderate Thunderstorm &
 Moderate Blowing Dust (T BD)
 E = Moderate Thunderstorm &
 Thick Blowing Dust & Thick
 Blowing Dust (T BD+)
 F = Heavy (Severe) Thunderstorm
 & Light Blowing Dust
 (T+ BD-)
 G = Heavy (Severe) Thunderstorm
 & Moderate Blowing Dust
 (T+ BD)
 H = Heavy (Severe) Thunderstorm
 & Thick Blowing Dust
 (T+ BD+)

63 Hail

0 = Heavy Hail (HL+)
 1 = Moderate Hail (HL)
 2 = Light Hail (HL-)
 3 = Heavy Hail (A+)
 4 = Moderate Hail (A)
 5 = Light Hail (A-)
 6 = Heavy Small Hail (AP+)
 7 = Moderate Small Hail (AP)
 8 = Light Small Hail (AP-)

64 Snow/Blowing Snow/
 Snow Showers

0 = Heavy Snow (S+)
 1 = Moderate Snow (S)
 2 = Light Snow (S-)
 3 = Thick Blowing Snow (BS+)
 4 = Blowing (Moderate) Snow (BS)
 5 = Light Blowing Snow (BS-)
 6 = Heavy Snow Showers (SW+)
 7 = Moderate Snow Showers (SW)
 8 = Light Snow Showers (SW-)
 9 = Light Snow & Light Blowing
 Snow (S- BS-)
 A = Light Snow & Blowing
 (Moderate) Snow (S- BS)
 B = Light Snow & Thick Blowing

Snow (S- BS+)
 C = Moderate Snow & Light
 Blowing Snow (S BS-)
 D = Moderate Snow & Blowing
 (Moderate) Snow (S BS)
 E = Moderate Snow & Thick
 Blowing Snow (S BS+)
 F = Heavy Snow & Blowing Snow
 (S+BS)
 G = Heavy Snow & Thick Blowing
 Snow (S+ BS+)
 H = Light Snow Showers & Light
 Blowing Snow (SW- BS-)
 I = Light Snow Showers & Blowing
 (Moderate) Snow (SW- BS)
 J = Light Snow Showers & Thick
 Blowing Snow (SW- BS+)
 K = Moderate Snow Showers &
 Light Blowing Snow (SW BS-)
 L = Moderate Snow Showers &
 Blowing (Moderate) Snow
 (SW BS)
 M = Moderate Snow Showers &
 Thick Blowing Snow (SW BS+)
 N = Heavy Snow Showers & Thick
 Blowing Snow (SW+ BS+)

65	Mist/Freezing Mist/ Drizzle/Freezing Drizzle	0 = Heavy Mist (MI+) 1 = Mist or Light Mist (MI-) 2 = Heavy Freezing Mist (ZMI+) 3 = Light Freezing Mist (ZMI-) 4 = Heavy Drizzle (L+) 5 = Moderate Drizzle (L) 6 = Light Drizzle (L-) 7 = Heavy Freezing Drizzle (ZL+) 8 = Moderate Freezing Drizzle (ZL) 9 = Light Freezing Drizzle (ZL-)
66	Fog/Ground Fog/ Haze/Tornado	0 = Thick (Dense) Fog (F+) 1 = Dense Fog (FF) 2 = (Moderate) Fog (F) 3 = Light Fog (F-) 4 = Thick (Dense) Ground Fog (GF+)

5= Dense Ground Fog (GFF)
 6 = Moderate Ground Fog (GF)
 7 = Light Ground Fog (GF-)
 8 = Damp Haze (F- -)
 9 = TORNADO (Always spelled Out

In Capital Letters)

67	Rain Squall/ Snow Squall/ Ice Crystals	0 = Severe Rain Squall (RQ+) 1 = Moderate Rain Squall (RQ) 2 = Mild Rain Squall (RQ-) 3 = Severe Snow Squall (SQ+) 4 = Moderate Snow Squall (SQ) 5 = Mild Snow Squall (SQ-) 6 = Heavy Ice Crystals (IC+) 7 = Moderate Ice Crystals (IC) 8 = Light Ice Crystals (IC-)
68	Haze/Sand/Smoke	0 = Thick Haze (H+) 1 = Hazy (Dry Haze) (H) 2 = Thick Blowing Sand (BSA+) 3 = Blowing Sand (BSA) 4 = Thick Blowing Sand (BN+) 5 = Moderate Blowing Sand (BN) 6 = Light Blowing Sand (BN-) 7 = Heavy (Thick) Smoke (K+) 8 = Moderate Smoke (Smoky) (K) 9 = Light Smoke (K-) A = Hazy (Dry Haze) & Light Smoke (H K-) B = Hazy (Dry Haze) & Moderate Smoke (H K) C = Hazy (Dry Haze) & Heavy (Thick) Smoke (H K+) D = Thick Haze & Light Smoke (H+ K-) E = Thick Haze & Moderate Smoke (H+ K) F = Thick Haze & Heavy (Thick) Smoke (H+ K+)
69	Sleet/Ice Fog	0 = Heavy Sleet (SL+) 1 = Moderate Sleet (SL)

2 = Light Sleet (SL-)
 3 = Heavy Sleet (E+)
 4 = Moderate Sleet (E)
 5 = Light Sleet (E-)
 6 = Thick (Dense) Ice Fog (IF+)
 7 = Moderate Ice Fog (IF)
 8 = Light Ice Fog (IF-)
 9 = Dense Ice Fog (IFF)

0 = Heavy Drifting Snow (GS+)
 1 = Moderate Drifting Snow (GS)
 2 = Light Drifting Snow (GS-)
 3 = Heavy Snow Pellets (SP+) or (OP+)
 4 = Moderate Snow Pellets (SP) or (OP)
 5 = Light Snow Pellets (SP-) or (OP-)
 6 = Heavy Snow Grains (SG+)
 7 = Moderate Snow Grains (SG)
 8 = Light Snow Grains (SG-)
 9 = Light Snow Pellet Showers (SPW-) or (OPW-)
 A = Moderate Snow Pellet Showers (SPW) or (OPW)
 B = Heavy Snow Pellet Showers (SPW+) or (OPW+)

Comma delimited

Air Temperature in Fahrenheit to tenths of a degree where available, decimal implied. Often the air temperature appears twice, once to tenths of a degree and in whole degrees. On the 1130-AER forms the air temp to tenths was occasionally entered above the value rounded to whole degrees and later on the WBAN-10 A or WBAN - 10B forms the air temperature is entered to whole degrees under temp, but under the dry bulb heading it is entered to tenths of a degree. Key the value entered as the Dry Bulb.

Position 72 = sign field; if positive blank
 fill, if negative enter a dash (-)
 Positions 73-75 whole degrees
 Position 76 = tenths of degree

e.g. Temp. = 43.6 pos. 72 = blank

73 = blank

74 = 4

75 = 3

tenths of degrees pos. 76 = 6

e.g. if temp. entry = 3; then,

Position 72 = blank

73 = blank

74 = blank

75 = 3

76 = blank, if temp entry, however,
 was = 3.0; then pos. 76 = 0

If entry was 102.2 degrees F then

pos 72 = blank

pos 73-76 = 1022

77

,

Comma delimited

78-81

Wet Bulb Temperature

The Wet Bulb Temperature is not a required entry on the 1130 Aer form series (no position provided on the form) and is only occasionally entered along with the temperature so the mandatory Dew Point Temperature can be computed and entered. However, on the WBAN forms the wet bulb temperature became a mandatory entry. The wet bulb temperature value always lies between the air temperature (dry bulb) and dew point temperature. Follow the same rules as for the air temperature entry above except that a wet bulb temperature of 100 F is unrealistic and therefore one less position is required.

Pos. 78 = sign field

79-80 = whole degrees F

81 = tenths position

Leave field blank when no entry available.

82

,

Comma delimited

83-85

Dew Point Temperature

Dew point temperatures over the years have been provided in two ways: The actual temperature to whole degrees F or the dew point depression in whole degrees (the number of degrees less than the air temperature). In some cases they may transition from depression to actual degrees within a single form. Rules for keying the dew point areas follows: If the keyer is unsure which is represented key the values as indicated on the form heading. If dew point temperature (also remember that a wet bulb temperature may have been inserted so they could compute the dew point in which both values may appear in the same entry box) then: Position 83 (sign field) = blank if positive dew point temperature. Position 83 = - (minus) if negative dew point temperature. Position 83 = 1 if dew point depression. Positions (84-85) = dew point temperature or dew point depression, right justify and blank fill. A dew point depression is always an absolute value.
e.g. if dew point temp = 50, then
Pos. 83 = blank
84 = 5
85 = 0
If dew point depression = 2, then
Pos. 83 = 1
84 = blank
85 = 2

86

,

Comma delimited

87-89










Wind Direction

16 point wind directions, during this period two standards were used the alpha codes and the arrow indicators:
Alpha Codes that follow shall be keyed as entered; left justify and blank fill.
N
NNE

NE
 ENE
 E
 ESE
 SE
 SSE
 S
 SSW
 SW
 WSW
 W
 WNW
 NW
 NNW
 C = Calm

16 point scale represented by arrows

Entry	Keying code	Meaning
C	00	Calm
↓ ↓	11	N
↓ ↗	12	NNE
↓ ↘	18	NNW
↖ ↗	22	NE
← ↗	32	ENE
← ←	33	E
← ↘	34	ESE

	44	SE
	54	SSE
	55	S
	56	SSW
	66	SW
	76	WSW
	77	W
	78	WNW
	88	NW

Note: The observer would occasionally only insert one arrow rather than two for those directions where both arrows were the same i.e. 11, 22, 33, 44, 55, 66, 77, 88.

e.g. if entry is ESE

Position 87 = E

Position 88 = S

Position 89 = E

e.g. if entry is

Position 87 = blank

Position 88 = 8

Position 89 = 8

If entry is calm caution should be taken regarding the conversion to alpha or numerical characters.

90	,	Comma delimited										
91	Wind Speed Indicator	1 = Speed is measured in miles per hour. 2 = Speed is measured in knots. 3 = Speed is measured in meters per second. 4 = Speed is estimated in miles per hour.										
92	,	Comma delimited										
93-95	Wind Speed	Wind speeds, right justify, blank fill. e.g. if entry = 4 Positions 93- 94 = blank Position 95 = 4 if entry = 15 mph, then Position 93 = blank Position 94 = 1 Position 95 = 5 if entry = 105 mph, then Position 93 = 1 Position 94 = 0 Position 95 = 5 if entry = Calm Positions 93-94 = blank Position 95 = 0 If wind speed indicator = 4, then wind speed was reported using the following U.S. Weather Bureau descriptive terms. The mid-point value of each range is keyed into the wind speed field (Positions 93-95) as indicated in the following table: <table><tr><td>Descriptive <u>Term</u></td><td>Mid-Point Wind <u>Speed (M.P.H)</u></td></tr><tr><td>Light (Lt)</td><td>4</td></tr><tr><td>Gentle (Gtl)</td><td>10</td></tr><tr><td>Moderate (Mdt)</td><td>15</td></tr><tr><td>Fresh</td><td>21</td></tr></table>	Descriptive <u>Term</u>	Mid-Point Wind <u>Speed (M.P.H)</u>	Light (Lt)	4	Gentle (Gtl)	10	Moderate (Mdt)	15	Fresh	21
Descriptive <u>Term</u>	Mid-Point Wind <u>Speed (M.P.H)</u>											
Light (Lt)	4											
Gentle (Gtl)	10											
Moderate (Mdt)	15											
Fresh	21											

Strong	31
Gale	46
Whole Gale	63
Hurricane	78

96	,	Comma delimited															
97	estimated wind speed	If the wind speed was estimated the letter E is placed immediately after the speed, e.g. 35E. If the E appears place it in position 97, otherwise, leave position 97 blank															
98	,	Comma delimited															
99	Character of the wind	<p>If following the wind speed one of the following letters appear use the following codes for position 99:</p> <table> <tr> <th>code</th><th>symbol</th><th>meaning</th></tr> <tr> <td>1</td><td>G- or -</td><td>Fresh gust</td></tr> <tr> <td>2</td><td>G or +</td><td>Strong gust</td></tr> <tr> <td>3</td><td>G+</td><td>Severe Gust</td></tr> <tr> <td>4</td><td>V</td><td>Variable</td></tr> </table> <p>Occasionally they may be written above the wind speed, e.g.</p> <p style="text-align: center;">SVR GSTS NW-34</p>	code	symbol	meaning	1	G- or -	Fresh gust	2	G or +	Strong gust	3	G+	Severe Gust	4	V	Variable
code	symbol	meaning															
1	G- or -	Fresh gust															
2	G or +	Strong gust															
3	G+	Severe Gust															
4	V	Variable															
100-102	Wind Gust	<p>Wind Gust information usually found in the remarks column preceded by a G</p> <p>e.g. if entry is 45 then</p> <p>Position 100 = blank</p> <p>Position 101 = 4</p> <p>Position 102 = 5</p>															
103	,	Comma delimited															
104-108	Barometer Station Pressure	The barometric station pressure is not a mandatory entry on the 1130															

	(Inches)	<p>forms, but often the value (to hundredths of an inch) is entered above the sea level barometric pressure which required derivation. On the WBAN forms the station pressure is a mandatory entry and is usually recorded to a thousandth of an inch. If available key to inches and thousandths, decimal implied.</p> <p>e.g. if 28.232 entered.</p> <p>Positions 104-108 = 28232</p> <p>If only recorded to hundredths of an inch, e.g. 28.23, then</p> <p>positions 104-107 = 2823</p> <p>position 108 = blank, when 4 digits entered left justify blank fill. Occasionally, the observer will only enter 3 digits by dropping the leading digit, e.g. 28.23 would be entered as 823 (units and hundredths digits only). In this example positions</p> <p>104 = blank</p> <p>105 = 8</p> <p>106 = 2</p> <p>107 = 3</p> <p>108 = blank</p>
109	,	Comma delimited
110-114	Sea Level Pressure (Millibars)	<p>Barometric Sea Level pressure is a required entry on the later forms. Right justify, blank fill, decimal implied. This field reserved for entries in millibars only if reported in inches key in following field. The entries often include only the last three values of the pressure reading leaving the first one or two positions implied, e.g. if the observed value was 1012.7 millibars only the 127 would be entered on the form by the observer. If e.g. the observed value was 998.2 millibars only 982 may be entered on the form. Key whatever the entry is, e.g. if the entry was 982, then</p> <p>Position 110 = blank</p> <p>Position 111 = blank</p>

Position 112 = 9

Position 113 = 8

Position 114 = 2

However if the entry was 998.2, then

Position 110 = blank

Position 111 = 9

Position 112 = 9

Position 113 = 8

Position 114 = 2

If entry were 1012.7, then positions 110-114
= 10127

115

,

Comma delimited

116-119

Barometric pressure
Sea Level (inches)

Barometric Sea Level pressure in inches is occasionally entered by the observer even though it is not a required entry. Positions 116-117 are reserved for whole inches and positions 118-119 for hundredths of an inch. However, the observer often drops the leading value, e.g. 30.05 inches is entered on the form as 005 and 29.98 inches as 998. Right justify the entry and blank fill if necessary. The decimal is implied. Positions 116-117 should generally range between 29 and 30 (this is the reason the leading digit can be dropped) and in no instances should the sea level pressure value in inches be below 28 or above 31.

e.g. Barometer (sea level) = 30.28

Positions 116-119 = 3028, if entered as 028, then position 116 = blank and positions 117-119 = 028. In the QA a cross check could be made between the sea level pressure in millibars versus inches if both available.

120

,

Comma delimited

121-123

Altimeter
(Inches)

Beginning in January 1940 the altimeter became a required entry.

The entries do not include the first digit but only the units position in inches and the value to the nearest hundredth of an inch. Decimal implied in observer entry.
e.g. if the entry = 968
Positions 121-123 = 968

Notes:

1) It was discovered that Abilene, Texas during the period 1930-1935 did not follow the published rules for observing cloud amounts instead they entered the cloud amounts in tenths along with the cloud type e.g. 6 CI ST, 7 ST CU, 6 A ST, etc. Based on this information a scheme will have to be developed so the information can be translated and keyed into the standard observing format as published by the Weather Bureau and followed by the majority of stations. There may be more locations other than Abilene that did not follow the proper procedures for coding cloud information, but we were unable to discovery others through our limited cursory check.

2) If only one entry in the Temperature/Dew Point column assume the entry is the air temperature and key accordingly.

3) Ensure that whenever the observer entered a ditto (“”) mark that the proper value is keyed.

4) Whenever an element field has a value to be keyed, but the value cannot be determined because of illegibility or non-recognizable characters by the keyer then place a tilde (~) in the last position of that element field. This will provide the data user with information that an entry was made by the observer but could not be keyed. If sufficiently interested the user can view the image.

3. **Start Date:** 1928.

4. **Stop Date:** 1948.

5. **Coverage:** U.S. Weather Bureau Stations (generally at airport locations) in the contiguous 50 states.

6. **How to Order Data:**

Ask NCDC's Climate Service about costs to obtain this dataset.

Phone: 828-271-4800

FAX: 828-271-4876

E-mail: NCDC.Orders@noaa.gov

7. **Archiving Data Center:**

National Climatic Data Center,
Federal Building

151 Patton Avenue
Asheville, NC 28801-5001

8. Technical Contact:

Name: Mark Seiderman
Address: National Climatic Data Center
NOAA/NESDIS
Veatch-Baley Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Voice Telephone: 828-271-4798
Fax: 828-271-4126
E-mail: Mark.Seiderman@noaa.gov

9. Known Uncorrected Problems: During the keying process if a value was entered on the form, but the keyer could not read the handwriting, a tilde (~) was placed in the element field. Where possible these entries should be corrected.

Some stations changed locations during this period (e.g., from the city office to an airport station, or from one airport to another). Where possible, these moves have been identified by a change in the WBAN station number; however, some station moves were made without a new WBAN number being assigned. Occasionally, all equipment was not moved to the new location simultaneously, resulting in a short period during which some elements were observed at the original site while the remaining elements were observed at the new site.

Some entries may contain uncorrected biases. In 1928, the three-cup anemometer was introduced as the primary instrument, but it was biased and required a correction. It was not until January 1, 1932 that all wind speeds had the anemometer correction applied.

During the period (mid-1930's) when the observation forms were revised, the observers sometimes entered dew point depression into the dew point column, or vice versa. These entries will be corrected when these data are converted into the Integrated Surface Hourly (ISH) format.

Another example of this type of problem was discovered involving the pressure elements. The problem became more acute in the later period, 1934-1948, during which as many as four columns were reserved for recording pressure: station pressure in inches, sea-level pressure in both millibars and inches, and altimeter in inches. The earlier period provided room for just one element: station pressure. It was discovered that sea-level pressure was occasionally entered into the station pressure column. But, in the later formats, a combination of field misplacements sometimes occurred. The errors that are identified in the raw keyed data will be corrected in the ISH output formatted data.

10. Quality Statement: These are "raw" keyed data, and have undergone limited quality control or quality assurance checks. A pre-keying check of the original

data forms was performed to correct obvious errors, and some internal bounds checking was performed on the data at keying. The data will undergo extensive automated quality control using limits, internal and temporal consistency checks provided by the Northeast Regional Climate Center (NRCC), and additional manual quality control at NCDC, before conversion to the ISH format (see references). Instructions to the keying contractor were to key the information as it appeared on the observational forms.

11. Essential Companion Datasets: The NCDC in-house station history files (DSI-9767) would be essential in correcting location (WBAN Number) errors. Other NCDC databases which cover this period may be used as a check on data values.

12. References:

The following references describe many of the data problems and how they were corrected at the Northeast Regional Climate Center in their efforts to quality control and convert the data to the ISH format.

"CDMP-SAO_QA_XII-04": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: Complex quality assurance checks for 1928-1948 hourly weather data as part of the Climate Database Modernization Program. Unpubl. Tech. Rep., 1 Dec. 2004, 10 pp.

"CDMP-SAO_QA_NRCC": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2003: Quality assurance procedures for historical hourly surface airways data. Unpubl. Tech. Rep., 1 Apr. 2003, 56 pp.

"Graybeal-etal_2002": Graybeal, D. Y., K. L. Eggleston, and A. T. DeGaetano, 2002: A climatology of extreme hourly temperature variability across the United States: Application to quality control. Preprints, 13th Conf. Appl. Climatol., Amer. Meteor. Soc., Portland, OR, paper 2.11, 4 pp.

"Graybeal-etal_2004a": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: New techniques in quality assurance of hourly meteorological: Resolving multiple flags through a decision tree. Preprints, 14th Conf. Appl. Climatol., Amer. Meteor. Soc., Seattle, WA, paper 7.2, 4 pp.

"Graybeal-etal_2004b": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: Complex quality assurance of historical hourly surface airways meteorological data. J. Atmos. Oceanic Technol., 21, 1156-1169.

"Graybeal-etal_2004c": Graybeal, D. Y., A. T. DeGaetano, and K. L. Eggleston, 2004: Improved quality assurance for historical hourly temperature and humidity: Development and application to environmental analysis. J. Appl. Meteor., 43, 1722-1735.

"Graybeal_2004": Graybeal, D. Y., 2004: Relationships among daily mean and peak gust wind speeds: Reanalysis for application to data quality assurance. Submitted to Int. J. Climatol., conditionally accepted.

